

What Is Claimed Is:

- 1 1. A method for quantifying a number of identical consecutive digits
2 starting from a fixed position within a string of n digits, comprising:
3 converting the string of n digits into a thermometer code, wherein the
4 thermometer code uses m bits to represent a string of m identical consecutive
5 digits within the string of n digits;
6 converting the thermometer code into a one-hot code in which only one bit
7 has a logical one value; and
8 converting the one-hot code into a logarithmic code representing the
9 number of identical consecutive digits.
- 1 2. The method of claim 1, wherein converting the string of digits into
2 the thermometer code involves passing the string of digits through $\lceil \log_2 n \rceil$ layers
3 of AND gates, wherein a first layer of AND gates produces thermometer codes for
4 sub-strings of length two, and wherein each consecutive layer produces
5 thermometer codes for sub-strings of length $k+1$ to $2k$ by ANDing together
6 thermometer codes for sub-strings of length 1 to k from preceding layers.
- 1 3. The method of claim 1,
2 wherein converting the thermometer code into the one-hot code involves
3 passing the thermometer code through a single layer of two-input comparator
4 gates;
5 wherein a given comparator gate produces a logical one value when a first
6 input of the comparator gate receives a logical one value and a second input
7 receives a logical zero value; and

8 wherein a comparator gate is coupled between each consecutive pair of
9 thermometer code bits, so that only one comparator gate, covering a boundary
10 between consecutive logical ones and consecutive logical zeros, produces a
11 logical one value.

1 4. The method of claim 1, wherein converting the one-hot code into
2 the logarithmic code involves passing the one-hot code through $\lceil \log_2 n \rceil - 1$ layers
3 of OR gates, wherein a given bit in the logarithmic code is produced by ORing
4 together bits of the one-hot code that cause the given bit in the logarithmic code to
5 be asserted.

1 5. The method of claim 1, wherein the string of n digits is a string of
2 n binary digits.

1 6. The method of claim 1, wherein the fixed position in the string of n
2 digits is the beginning of the string, so that the number of leading identical
3 consecutive digits is quantified.

1 7. The method of claim 6, wherein the number of leading zero values
2 is quantified.

1 8. The method of claim 7, further comprising using the logarithmic
2 code to normalize a result of a floating-point arithmetic operation.

1 9. The method of claim 1, further comprising using the logarithmic
2 code to encode or decode a stream of data, wherein the logarithmic code
3 represents a run-length of identical consecutive digits within the stream of data.

1 10. The method of claim 1, wherein each digit in the string of n digits
2 includes one or more binary digits.

1 11. An apparatus that quantifies a number of identical consecutive
2 digits starting from a fixed position within a string of n digits, comprising:
3 a thermometer code circuit that converts the string of n digits into a
4 thermometer code, wherein the thermometer code uses m bits to represent a string
5 of m identical consecutive digits within the string of n digits;
6 a one-hot code circuit that converts the thermometer code into a one-hot
7 code in which only one bit has a logical one value; and
8 a logarithmic code circuit that converts the one-hot code into a logarithmic
9 code representing the number of identical consecutive digits.

1 12. The apparatus of claim 11, wherein the thermometer code circuit
2 includes $\lceil \log_2 n \rceil$ layers of AND gates, wherein a first layer of AND gates produces
3 thermometer codes for sub-strings of length two, and wherein each consecutive
4 layer produces thermometer codes for sub-strings of length $k+1$ to $2k$ by ANDing
5 together thermometer codes for sub-strings of length 1 to k from preceding layers.

1 13. The apparatus of claim 11,
2 wherein the one-hot-code circuit includes a single layer of two-input
3 comparator gates;
4 wherein a given comparator gate produces a logical one value when a first
5 input of the comparator gate receives a logical one value and a second input
6 receives a logical zero value; and

7 wherein a comparator gate is coupled between each consecutive pair of
8 thermometer code bits, so that only one comparator gate, covering a boundary
9 between consecutive logical ones and consecutive logical zeros, produces a
10 logical one value.

1 14. The apparatus of claim 11, wherein the logarithmic code circuit
2 includes $\lceil \log_2 n \rceil - 1$ layers of OR gates, wherein a given bit in the logarithmic code
3 is produced by ORing together bits of the one-hot code that cause the given bit in
4 the logarithmic code to be asserted.

1 15. The apparatus of claim 11, wherein the string of n digits is a string
2 of n binary digits.

1 16. The apparatus of claim 11, wherein the fixed position in the string
2 of n digits is the beginning of the string, so that the number of leading identical
3 consecutive digits is quantified.

1 17. The apparatus of claim 16, wherein the apparatus quantifies the
2 number of leading zero values.

1 18. The apparatus of claim 17, further comprising a floating-point
2 arithmetic unit that is configured to use the logarithmic code to normalize a result
3 of a floating-point arithmetic operation.

1 19. The apparatus of claim 11, further comprising an encoder that is
2 configured to use the logarithmic code to encode or decode a stream of data,

1 wherein the logarithmic code represents a run-length of identical consecutive
2 digits within the stream of data.

1 20. The apparatus of claim 11, wherein each digit in the string of n
2 digits includes one or more binary digits.

1 21. A computer system including a circuit that quantifies a number of
2 identical consecutive digits, comprising:
3 a processor;
4 a memory;
5 a quantifying circuit that quantifies the number of identical consecutive
6 digits starting from a fixed position within a string of n digits, wherein the
7 quantifying circuit includes,
8 a thermometer code circuit that converts the string of n
9 digits into a thermometer code, wherein the thermometer code uses
10 m bits to represent a string of m identical consecutive digits within
11 the string of n digits;
12 a one-hot code circuit that converts the thermometer code
13 into a one-hot code in which only one bit has a logical one value,
14 and
15 a logarithmic code circuit that converts the one-hot code
16 into a logarithmic code representing the number of identical
17 consecutive digits.

1 22. The computer system of claim 21, further comprising:
2 a floating-point arithmetic unit of within the processor;

3 wherein the quantifying circuit is located within the floating-point
4 arithmetic unit and is configured to normalize results of floating-point operations.

1 23. The computer system of claim 21,
2 wherein the computer system includes an encoding circuit for encoding or
3 decoding streams of data; and
4 wherein the quantifying circuit is located within the encoding circuit and is
5 configured to quantify run-lengths of identical consecutive digits for the encoding
6 circuit.